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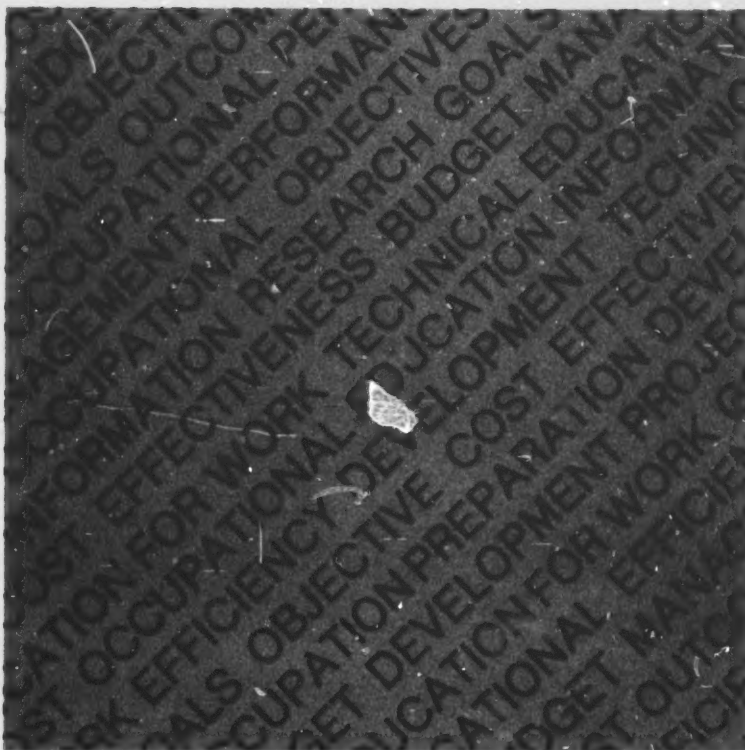
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ABSTRACT

This manual is basically designed as a self-instructional guide by which postsecondary vocational administrators and educators can conduct cost-effectiveness/benefit studies. (Cost-effectiveness/benefit analysis is an evaluation technique which can be used for assessing outcomes of existing and/or new programs in relation to their specified program objectives and against their program costs, and can be used as a systems analysis technique, evaluation method, and planning tool for vocational programs.) The manual summarizes the cost-effectiveness/benefit model for postsecondary vocational programs, and it provides guidelines for conducting cost-effectiveness/benefit analyses by following step-by-step procedures in the planning, implementing, and utilizing phases. A set of program objectives and target goal statements, a data form for determining target goals and outputs, a program cost analysis form, and tables for computing cost-benefit measures are appended. (The complete model, forms, and procedures for using the model are also published in a separate technical report.)
 (Author/DTT)

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ADMINISTRATOR'S MANUAL

COST-EFFECTIVENESS/BENEFIT ANALYSIS OF
POSTSECONDARY VOCATIONAL PROGRAMS

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October, 1977

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ABSTRACT

Purposes. The purpose of the postsecondary cost-effectiveness project is to develop a cost-effectiveness/benefit analysis model and user's manual for postsecondary vocational programs. The specific objectives of this manual are: (1) to specify step-by-step activities needed for conducting a cost-effectiveness/benefit study and (2) to provide vocational administrators with guidelines and data forms for using the model. (The complete model, forms, and procedures are also published separately in a technical report).

Procedures and Products. This manual summarizes the cost-effectiveness/benefit analysis model for postsecondary vocational programs, and it provides guidelines for conducting cost-effectiveness/benefit analyses by following step-by-step procedures in the planning, implementing, and utilizing phases. A set of program objectives and target goal statements, a data form for determining target goals and outputs, a program cost analysis form, and tables for computing cost-benefit measures are appendixes.

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CHAPTER I

INTRODUCTION

A. *What are the objectives of the manual?*

• Objectives of the Manual

The manual is basically designed as a self-instructional guide by which postsecondary vocational administrators and educators can conduct cost-effectiveness/benefit studies. The objectives are:

1. To increase awareness of the cost-effectiveness/benefit analysis model for postsecondary vocational programs.
2. To provide step-by-step procedures and analytical techniques for cost-effectiveness/benefit study.
3. To assist postsecondary vocational administrators to improve management skills so as to increase program effectiveness, cost efficiency, and performance in postsecondary vocational education.

B. *How was the manual developed?*

• Development of the Manual

This manual was developed at Indiana University-Bloomington with the financial support of the State Board of Vocational and Technical Education in the period from July 1, 1976 to October 31, 1977.

1. The manual outlines the cost-effectiveness/benefit analysis model for postsecondary vocational programs.

2. The manual provides guidelines for using the model and data forms.
3. The manual develops step-by-step activities for the planning, implementing, and utilizing phases of a cost-effectiveness/benefit study.

C. How is the manual organized?

• Organization of the Manual

The manual is organized into six chapters. The remaining chapters present: (1) orientation to the cost-effectiveness/benefit analysis model, (2) planning activities, (3) implementing activities, (4) utilizing activities, and (5) concluding remarks.

1. Chapter II draws attention to the cost-effectiveness/benefit analysis model by defining and summarizing it.
2. Chapter III describes the planning activities for a cost-effectiveness/benefit study.
3. Chapter IV presents the activities for implementing a cost-effectiveness/benefit study.
4. Chapter V discusses ways to utilize the resulting measures from the study.
5. Chapter VI makes concluding remarks and suggestions for using the model.

CHAPTER II

ORIENTATION TO THE COST-EFFECTIVENESS/BENEFIT ANALYSIS MODEL

A. *What is cost-effectiveness/benefit analysis?*

- Definition

Cost-effectiveness/benefit analysis is an analytical technique for assessing outcomes of existing and/or new programs in relation to their specified program objectives and against their program costs.

The cost-effectiveness/benefit analysis can be used as a systems analysis technique, evaluation method, and planning tool for vocational programs.

B. *What is the cost-effectiveness/benefit analysis model for postsecondary vocational programs?*

- The Cost-Effectiveness/Benefit Analysis Model

The conceptual model is a simplified representation of relationships among the components involved in analyzing the cost-effectiveness/benefit of postsecondary vocational programs. Within the input-output framework, the model specifies four major components and generates three kinds of cost-effectiveness/benefit measures (see Figure I).

1. *Vocational program classification*

12 The postsecondary vocational programs can be classified by either the U.S. Office of Education code or HEGIS classification scheme. The model is directed to analyze the cost-effectiveness/benefit of the postsecondary occupational sub-program areas or courses within the program areas.

2. *Program objectives*

The postsecondary vocational program objectives can be stated in a time frame by which they are matched with such factors as

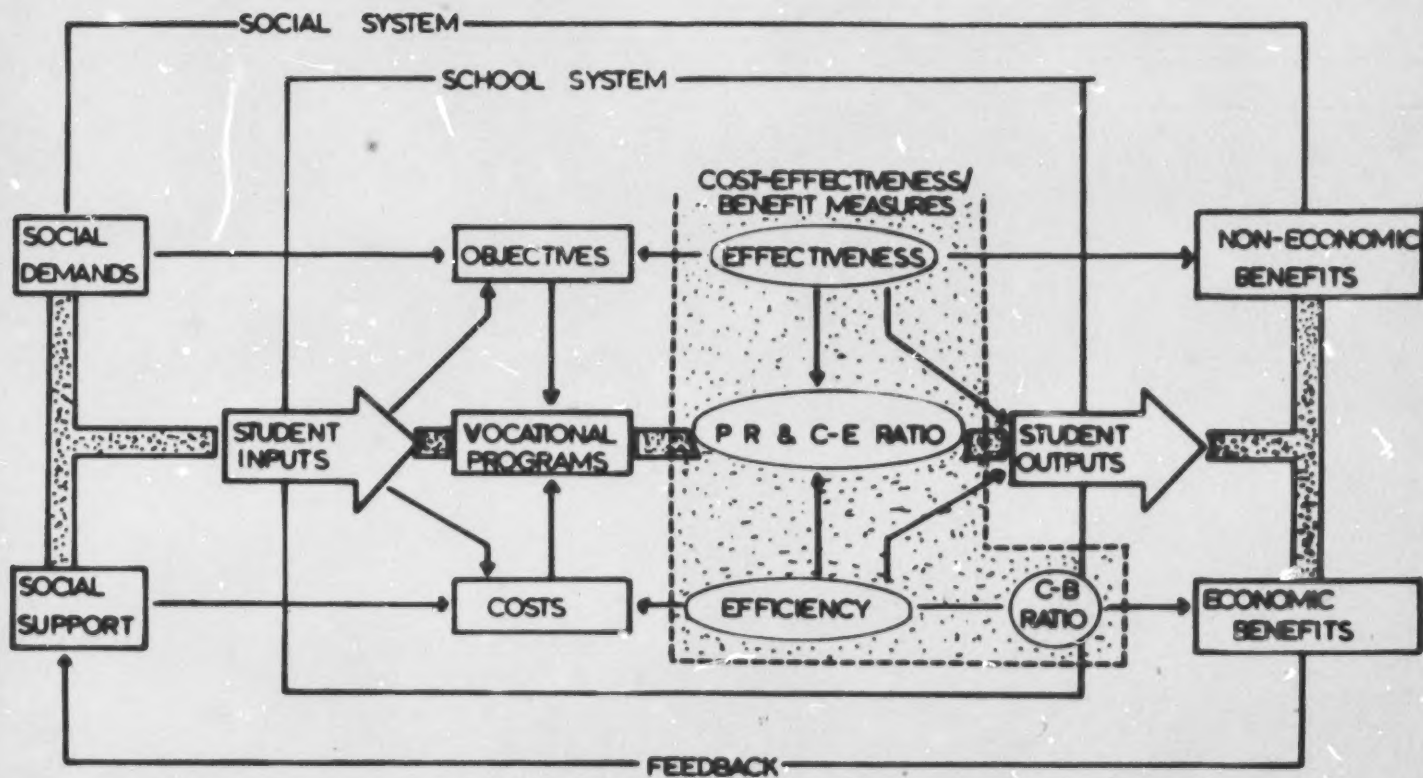


FIGURE 1 A COST-EFFECTIVENESS/BENEFIT ANALYSIS MODEL FOR POSTSECONDARY VOCATIONAL PROGRAMS

enrollment, preparation, placement and advanced studies, and job satisfaction and economic benefits. These are:

- (1) Students' enrollment in the occupational program
- (2) Occupational preparation for career development
- (3) Program completers' placement to meet manpower demands
- (4) Completers' election of advanced studies
- (5) Increase in program completers' job satisfaction, status, and economic benefits

Each of the program objectives is specified in measurable terms as target goals (see Appendix A).

3. Program outputs

Program outputs are actual outcomes from the vocational program. Output indicators can be compared with predetermined target goals.

4. Program costs

Program costs are annual expenses for operating vocational programs at the institutional level. Annual expenses can be determined by direct and indirect costs. Direct costs include the following six items:

- (1) Annual salaries of teaching staff
- (2) Fringe benefits for teaching staff
- (3) Purchased services
- (4) Instructional supplies and materials
- (5) Instructional equipment
- (6) Instructional space

Indirect costs can include:

- (1) Departmental administration and support service costs
- (2) College administration and support services costs
- (3) Institutional administration and support service costs

The sum of the direct and indirect costs is the total program cost. Student opportunity cost or foregone income can be added to the program costs when comparing a total of program operation and student opportunity costs with completers' future earnings.

5. Program effectiveness

Effectiveness is a measure of goal attainment, that is, the extent to which specified target goals are achieved.

$$\text{Effectiveness Score(s)} = \frac{\text{Output(s)}}{\text{Target Goal(s)}}$$

Effectiveness index:

- (1) Composite program effectiveness index
- (2) Average program effectiveness index
- (3) Weighted composite effectiveness index
- (4) Weighted average effectiveness index

6. Cost efficiency

Internal efficiency is measured by the unit cost:

$$\text{Unit Cost} = \frac{\text{Total Costs}}{\text{Unit of Output(s)}}$$

External efficiency is computed by cost-benefit measures such as:

- (1) Net percent value of incomes
- (2) Cost-benefit ratio
- (3) Internal rate of return

Performance efficiency is measured by dividing the actual unit cost by the budgeted or average unit cost:

$$\text{Performance Efficiency Index} = \frac{\text{Actual Unit Cost}}{\text{Budgeted or Average Unit Cost}}$$

7. Cost-effectiveness ratio and performance ratio

The cost-effectiveness ratio indicates the degree of goal attainment per unit cost as follows:

$$\text{Cost-Effectiveness Ratio} = \frac{\text{Effectiveness Index}}{\text{Actual Unit Cost}}$$

The performance ratio is a criterion by which to evaluate the degree of management performance.

$$\text{Performance Ratio} = \frac{\text{Effectiveness Index}}{\text{Performance Efficiency Index}}$$

C. *What is the procedure for using the cost-effectiveness/benefit analysis model?*

• Procedures for Using the Model

A standard procedure has been developed for using the cost-effectiveness/benefit analysis model. The procedure involves nine steps within the planning, implementing, and utilizing phases (see Figure II).

1. *Planning a cost-effectiveness/benefit study*

When the planning phase starts, determine the purposes of the study, identify appropriate resources, and develop a study plan for achieving the purposes.

- (1) Determine the purposes of a cost-effectiveness/benefit study
- (2) Identify available resources for the study
- (3) Develop a study plan

2. *Implementing a cost-effectiveness/benefit study*

Implement the analysis according to the schedule in the plan. The implementing phase includes:

- (1) Determine target goals
- (2) Assess program outputs
- (3) Analyze program costs
- (4) Compute cost-effectiveness/benefit measures

3. *Utilizing the results from the study*

After the study is finished, interpret the measures and report them to decision-makers so that they can utilize the results in the decision-making process.

- (1) Interpret the measures
- (2) Utilize the results for program evaluation, development, and planning

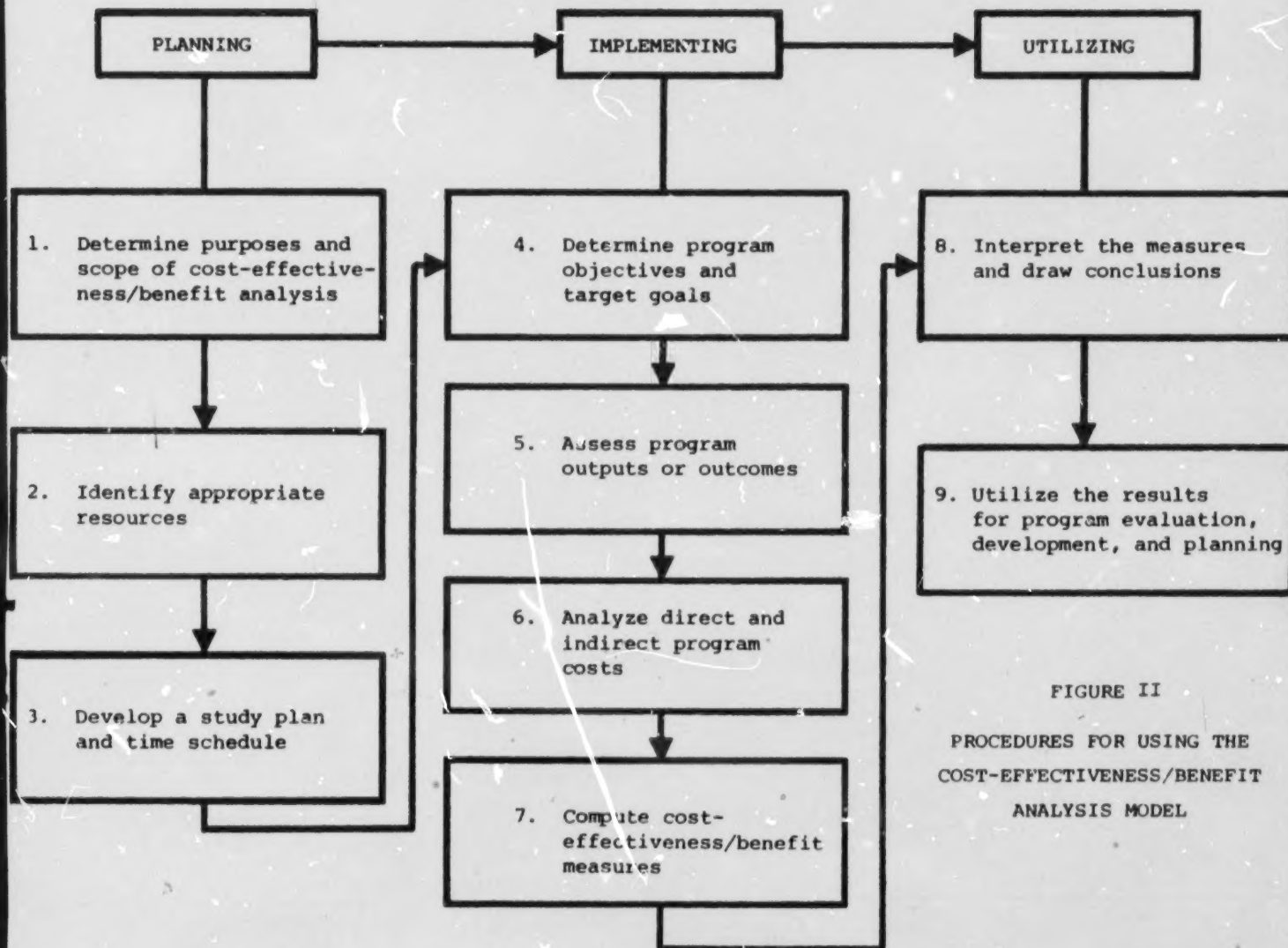


FIGURE II
PROCEDURES FOR USING THE
COST-EFFECTIVENESS/BENEFIT
ANALYSIS MODEL

CHAPTER III

PLANNING A COST-EFFECTIVENESS/BENEFIT ANALYSIS

A. *What are the purposes and scope of cost-effectiveness/benefit study?*

• Purposes of a Cost-Effectiveness/Benefit Study

The first step is to determine the purpose of the study. Its needs and scope should be specified by defining the purposes.

1. *Define the purpose of the study.*

Define the purpose by identifying the needs for improved program operation and by determining what information is needed for decision-making and/or improving public understanding and support for programs.

2. *Anticipate what information is needed from the study.*

Anticipate and describe what information should be gathered for program evaluation, development, or planning.

3. *Specify the scope of the study.*

Specify the scope of the study in terms of a number of programs, time period, and depth of analysis.

Planning Activity	Remark
1. Define the purpose of the study.	The purpose of the analytical study should be defined on the basis of decision situations.
A cost-effectiveness/benefit analysis can be used for the following purposes: 1.1 Improving vocational program management. Use it as a management tool to improve the effectiveness, efficiency, and performance of the programs. 1.2 Providing information needed for resource allocation and utilization. Use it as a decision model to provide decision-makers with useful criteria for allocating or utilizing a given amount of resources to the most worthy of occupational programs. 1.3 Increasing public understanding and support. Use appropriate information from the analysis to increase public understanding and to provide a rationale for supporting vocational programs.	

Planning Activity	Remark
2. <i>Anticipate what information is needed from the study.</i>	To achieve the study's purpose, the anticipated information should be clearly identified.
It is possible to anticipate the following information from the study: 2.1 What are the specific objectives and target goals of the program? 2.2 What are immediate outcomes and long-range outputs or benefits of the program? 2.3 What are the direct costs and indirect costs of the program? 2.4 What are the immediate effectiveness and the long-range effectiveness of the program? 2.5 What are the internal efficiency, performance efficiency, and external efficiency or cost-benefit measures of the program? 2.5 What are the cost-effectiveness ratio and performance ratio?	

Planning Activity	Remark
3. <i>Specify the scope of the study.</i>	The scope of the study should be defined in terms of number of programs, time period, and depth of analysis.
The scope of the study can be specified by answering the following questions: 3.1 What programs or how many programs will you analyze? • One or more programs within an institution. • One or more programs between institutions. 3.2 What time periods will you consider? • Past year(s) • Current year • Future year(s) 3.3 How will you analyze? • Descriptions of information on the program operation. • Measurement of effectiveness and/or efficiency. • Relationship between effectiveness and efficiency.	

B. *What resources should be available to implement the analysis?*

• Identification of Appropriate Resources

Personal and financial resources available to the analysis should be identified.

4. *Organize a study team and advisory committee.*

Organize a study team to implement a cost-effectiveness/benefit study. Assign specific responsibilities to the team leader and members.

5. *Identify financial resources.*

Make available appropriate financial resources to implement the study.

Planning Activity	Remark
4. <i>Organize a study team and advisory committee.</i>	A study team should be organized to implement the study and if it is necessary, advisory committee members and/or consultants should be invited.
4.1 Select team leader and members with the following considerations: • Involve key staff members in a decision-making process. • Encourage staff participation in the study. • Schedule an in-service training workshop to provide participants with an understanding of cost-effectiveness/benefit analysis concepts and techniques. 4.2 Invite advisory committee members and consultants. An advisory committee should consist of representatives from the administrative body, faculty, and business. If it is needed, invite consultants from professional institutions for technical assistance.	

Planning Activity	Remark
5. <i>Identify financial resources and make a budget for the study.</i>	Financial resources should be identified to prepare for a budget.
5.1 Identify financial resources from the following sources: • Institution's R & D funds • Governmental R & D funds • Private foundations 5.2 Make a budget which will include the following items: • Personnel: team leader/ members • Contracted services • Travel • Supplies and materials • Follow-up data collection • Report production • Other	

C. *How can a study plan and time schedule be developed?*

• Development of a Study Plan

To carry out the study, a plan for a cost-effectiveness/benefit analysis should be developed including a design of the study and a time schedule for the procedural activities.

6. *Design a cost-effectiveness/benefit study.*

Design the analytical study with consideration to institutional setting, program status, and data types needed for the study.

7. *Develop a time schedule.*

Make a time schedule which indicates the procedural activities from start to completion of the study.

Planning Activity	Remark
6. <i>Design a cost-effectiveness/benefit study.</i>	A cost-effectiveness/benefit study should be designed to specify the objectives, to collect available data, and to analyze the collected data.
6.1 Specify the objectives of the study. Based on the purpose, anticipated information, and scope of the analysis, specify the objectives of the study. 6.2 Identify data types. Using the objectives, determine the data types needed for the analysis: historical, current, and/or projected data. 6.3 Identify analytical schemes and cost-effectiveness measures. 6.4 Determine the dates for the study.	

Planning Activity	Remark
7. <i>Develop a time schedule for the study.</i>	The time schedule can start with determination of program objectives at the beginning of the school year. After the school year is over, appropriate data can be collected and analyzed to compute cost-effectiveness/benefit measures.
7.1 Prepare the study. • Review the model • Conference/workshop 7.2 Hold advisory committee meeting (1). 7.3 Determine program objectives/target goals. 7.4 Collect program output data. • Review school records • Survey follow-up information 7.5 Analyze program cost data. • Assign direct costs • Prorate indirect costs 7.6 Compute cost-effectiveness/benefit measures. • Program effectiveness measures • Cost efficiency measures • Cost-effectiveness ratio and performance ratio 7.7 Interpret the resulting measures. 7.8 Hold advisory committee meeting (2). 7.9 Prepare the final report.	

CHAPTER IV

IMPLEMENTING A COST-EFFECTIVENESS/BENEFIT STUDY

A. *How can program objectives/target goals be determined?*

Determination of Program Objectives/Target Goals

At the beginning of the school year, define program objectives and determine target goals with consideration to program characteristics, policy preferences, and data availability. For this, the following activities are suggested:

1. *Define the program objectives.*

Organize administrators and teaching faculty to review the institutional missions, input information on social demand and support, and student characteristics and to define the program objectives. For this, refer to the program objectives and target goal statements as developed in the model.

2. *Determine the selected target goals.*

Considering the program characteristics, policy preferences, and data availability, select a number of objectives and target goals and define them in measurable terms.

Implementing Activity	Remark
1. <i>Define the program objectives.</i>	The program objectives can be defined with reference to the program objectives and target goal statements (see Appendix A).
1.1 Review the following documents and information: (1) Institutional missions (2) Social demands and supports (3) Student characteristics (4) Other related information 1.2 Refer to the program objective and target goal statements which include: (1) Student's enrollment (2) Occupational preparation (3) Placement and employment (4) Advanced studies (5) Increase in economic benefits 1.3 Define the program objectives. Define the program objectives on the basis of the above information.	

Implementing Activity	Remark
2. Determine the program target goals.	A number of target goal statements can be selected to determine program target goals in measurable terms (use Appendix B).
2.1 Select a number of program objectives and target goals.	
Considering the program characteristics, policy preferences, and data availability, select a number of objectives and target goal statements.	
2.2 Determine the target goals for operating the program.	
Determine the selected target goals in measurable terms.	

B. *How can the program outputs be assessed?*

• Assessment of Program Outputs

After the school year is over, collect and analyze program output data in accordance with the predetermined program target goals.

3. *Collect the related program output data.*

Collect the related program output data through a review of student records and follow-up surveys.

4. *Identify the program output indicators.*

Analyze the collected data to identify program output indicators in accordance with the predetermined target goals.

Implementing Activity	Remark
3. <i>Collect the related program output data.</i>	Program output data can be collected from student records and follow-up survey.
3.1 Review student records to collect the following data: (1) Number of enrollments (2) Student credit hours (3) Curricular activities (4) Guidance services (5) Program completers (6) Other related data 3.2 Conduct a follow-up survey to identify the following information: (1) Placement (2) Advanced studies (3) Employed students' job satisfaction, and monetary benefits (4) Employers' opinion (5) Other related information	

Implementing Activity	Remark
4. <i>Identify the program output indicators.</i>	Program output indicators should be identified in accordance with the pre-determined target goals (use Appendix B).
4.1 Analyze the program output data. Analyze the program output data, using the data form for determining program outputs as appears in Appendix B. 4.2 Identify the program output indicators. Identify the program output indicators and compare them with the predetermined target goals.	

C. *How can the program costs be analyzed?*

• Analysis of Program Costs

Compute program costs by adding directly related costs to indirect supporting services costs.

If the study is also concerned with cost-benefit measures, add the student opportunity cost to the program costs.

5. *Analyze program direct costs.*

Identify directly related line items for the occupational program to analyze direct costs.

6. *Prorate program indirect costs.*

Prorate expenditures for administrative and supporting services at the departmental, school, and institutional levels on the basis of full-time equivalent students or faculty members.

7. *Identify student opportunity costs.*

Identify student opportunity costs by computing students' foregone income for the time while students are studying at the postsecondary institution.

Implementing Activity	Remark
5. <i>Analyze program direct costs.</i>	Expenditures for line items can be analyzed as program direct costs (see Appendix C).
5.1 Annual salaries of teaching staff within the occupational program. Assign annual salaries of teaching staff including instructional assistants to the program on the basis of teaching time allotted to a given program. 5.2 Fringe benefits for teaching staff within the program. Compute fringe benefits for the teaching staff by either: (1) Adding actual amounts paid by the institution for retirement, social security, medical insurance, life insurance, and other benefits, or (2) Multiplying total salaries assigned to the program by a certain percent of fringe benefits paid by the institution. 5.3 Purchased services. Purchased services costs include amounts paid for the per institutional services of individuals who are not on the regular payroll and for travel for instructional purposes.	

Implementing Activity	Remark
5.4 Instructional supplies and materials. Assign expenditures for instructional supplies and materials to the program on the basis of student credit hours.	
5.5 Instructional equipment. Instructional equipment costs include yearly depreciated costs, repair, and replacement expenses. If the use of equipment is shared with other programs, prorate the annual costs to a given program on the basis of percentage of use in the program.	
5.6 Instructional space. Estimate the annual cost of building space used by the program by dividing the original cost by life expectancy and multiplying this by the proportion of space and time used for the program. When analyzing program costs within the institution, exclude the instructional space costs from the direct costs of the program.	
5.7 Sub-total of program direct costs. Add costs for the above items to the program direct costs.	

Implementing Activity	Remark
6. <i>Prorate program indirect costs to the program.</i>	Prorated expenditures for administrative and support services can be considered as indirect costs of the program.
6.1 Departmental administrative and support services. Prorate the salaries of department chairperson and support staff and costs of departmental supplies and expenses to the program on the basis of student credit hours. 6.2 College administration and support services. Prorate the salaries of the deans and support staff and costs of supplies and expenses at the college level to the program on the basis of full-time equivalent teaching staff. 6.3 Institutional administration and support services. (1) Prorate institutional administration costs to the program on the basis of full-time equivalent teaching staff. (2) Prorate library and student services costs to the program according to the proportion of students enrolled in the program.	

Implementing Activity	Remark
(3) Prorate costs for physical plant operation and maintenance to the program by the proportion of time/floor units for the program. (4) Prorate auxiliary service costs for faculty by the proportion of teaching staff, and prorate auxiliary service costs for students by the proportion of students enrolled in the program.	
6.4 Sub-total of program indirect costs. Add costs of all administrative and support services to the indirect costs of the program.	

Implementing Activity	Remark
7. <i>Identify the student opportunity costs.</i>	The student opportunity costs can be identified with the students' foregone income for the years while they are enrolled in the program.
7.1 Identify annual foregone income for the students enrolled in the program. Account for the annual foregone income for the students who are enrolled in the postsecondary occupational program by the average annual earnings of high school graduates who are not in postsecondary programs. 7.2 Add the average annual foregone incomes for the number of program years. Identify the opportunity costs or foregone incomes for the students who are enrolled in the two-year postsecondary programs by finding the sum of two years' annual average incomes of the high school graduates.	

- D. *How can cost-effectiveness/benefit measures be computed for postsecondary occupational programs?*

• Computation of Cost-Effectiveness/Benefit Measures

Based upon program objectives, outputs and costs data, compute the program effectiveness, cost efficiency, cost-effectiveness and performance ratio, and cost-benefit measures for postsecondary occupational programs.

8. *Compute program effectiveness measures.*

Program effectiveness can be measured by:

- (1) Program effectiveness score(s)
- (2) Composite program effectiveness index
- (3) Average program effectiveness index
- (4) Weighted composite program effectiveness index.
- (5) Weighted average program effectiveness index.

9. *Compute cost efficiency measures.*

Measure cost efficiency by the unit cost and the efficiency index.

10. *Compute cost-effectiveness and performance ratio.*

Compute these measures by comparing program effectiveness measures with cost efficiency measures.

11. *Compute cost-benefit measures.*

Cost-benefit measures include:

- (1) Net present value of increased incomes
- (2) Cost/benefit or benefit/cost ratio
- (3) Internal rate of return

Implementing Activity	Remark
8. Compute program effectiveness measures.	Program effectiveness can be measured by dividing actual outputs by the pre-determined target goals.
8.1 Compute effectiveness score(s) for the program. Express the program effectiveness score by the percent of goal attainment as follows: $PE (\%) = \frac{\text{Output}}{\text{Goal}} \times 100$ Compute effectiveness scores of selected goal attainments. If it is necessary, weight each effectiveness score according to the degree of its importance or policy preference. 8.2 Draw the following program effectiveness indexes. (1) Composite program effectiveness index: A sum of all effectiveness scores. (2) Average program effectiveness index: A sum of effectiveness scores divided by the number of scores.	

Implementing Activity	Remark
(3) Weighted composite program effectiveness index: A sum of weighted effectiveness scores.	
(4) Weighted average program effectiveness index: A sum of weighted effectiveness scores divided by the number of weighted points.	

Implementing Activity	Remark
9. <i>Compute cost efficiency measures for the program.</i>	Cost efficiency can be measured by unit costs and indexed by dividing actual unit cost by expected unit costs.
9.1 Compute unit costs. Three kinds of unit costs can be computed: (1) Cost per student: Total program costs divided by total number of students who are enrolled in the program. (2) Cost per student credit hour: Total program costs divided by total number of student credit hours within the program. (3) Cost per completer: Total program costs divided by total number of students who completed the program. 9.2 Compute cost efficiency index for the program. Make cost efficiency index by dividing the actual unit cost by the budgeted or average unit cost.	

Implementing Activity	Remark
10. <i>Compute cost-effectiveness ratio and performance ratio for the program.</i>	The ratio can be computed by the relationship between effectiveness and efficiency measures.
10.1 Compute cost-effectiveness ratio. Compute the cost-effectiveness ratio by dividing the average program effectiveness index by the actual unit cost per student enrolled in the program. 10.2 Compute performance ratio. Compute the performance ratio by dividing the average program effectiveness index by the cost efficiency index.	

Implementing Activity	Remark
11. <i>Compute cost-benefit measures for the program.</i>	Cost-benefit measures can be computed by the relationship between total costs and program completers' future increased incomes as the result of the training in the program (use Tables in Appendix D).
11.1 Determine the total costs. Determine the total costs by direct and indirect program costs plus student opportunity costs. 11.2 Determine average annual increased income of the program completers. Determine the average annual increased income (II) by subtracting the average annual income of the high school graduates (I') from that of the postsecondary program completers (I) as follows: $II = I - I'$ 11.3 Determine the average annual income growth rate (k) and working periods or number of years (n) and compute a total of increased incomes by the following: $TII = \sum_{t=1}^n (I - I') (1+k)^{t-1}$	

Implementing Activity	Remark
11.4 Determine the annual discount rate (r) and compute the present value of the increased incomes (PVII₀) using the following formula: $PVII_0 = \sum_{t=1}^n \frac{II (1+k)^{t-1}}{(1+r)^t}$ 11.5 Compute the net present value of increased incomes (NPV₀). Measure the net present value by subtracting from the present value of increased incomes the present value of costs (C₀): $NPV_0 = PVII_0 - C_0$	
11.6 Compute the cost-benefit ratio. Compute the cost-benefit ratio (C-BR) by dividing the present value of increased incomes (PVII₀) by the present value of costs (C₀): $C-BR = PVII_0 \div C_0$	
11.7 Compute the internal rate of return (r). Compute the internal rate of return by solving the following equation: $\sum_{t=1}^n \frac{II (1+k)^{t-1}}{(1+r)^t} = C_0, \text{ or}$ $\sum_{t=1}^n \frac{(1+k)^{t-1}}{(1+r)^t} = \frac{C_0}{II}$	

CHAPTER V

UTILIZING THE RESULTS FROM THE STUDY

A. *How can the results from the study be interpreted?*

• Interpretation of the Results

Interpret the results of cost-effectiveness/benefit measures and discuss them among the concerned people. Then make a study report to the decision-makers.

1. *Interpret the results from the study.*

Interpret the results from the study with a review of the process.

2. *Develop conclusions and recommendations for the program.*

Based upon the results and interpretation conclusion, make conclusions and recommendations and discuss them among the concerned people.

3. *Prepare a study report.*

Prepare a final study report for decision-makers to use in their program evaluation, development, and planning processes.

Utilizing Activity	Remark
1. <i>Interpret the results from the study.</i>	The results should be interpreted with careful consideration of the implementing procedure.
1.1 Interpret program effectiveness measures. Employ program effectiveness measures to judge how effective the program is. When doing so, the following points should be taken into consideration: (1) Were program objectives appropriately selected? (2) Were target goals adequately determined? (3) What effectiveness measures are most reliable to judge program effectiveness? 1.2 Interpret cost efficiency measures. Use cost efficiency measures as criteria for judging how efficient the program is. When interpreting these measures, the following questions are critical: (1) What cost items were included? (2) How were costs assigned or prorated to the program?	

Utilizing Activity	Remark
(3) What efficiency measures are most reliable to judge if the program was operated in an efficient way? 1.3 Interpret cost-effectiveness ratio and performance ratio. The cost-effectiveness ratio is a criterion for judging program effectiveness in relation to the associated costs. The performance ratio indicates the degree of program management performance on the basis of program effectiveness and cost efficiency measures. 1.4 Take additional points into consideration. For a comparison of two or more programs among institutions, the following points should be fully considered: (1) Were effectiveness scores and indexes based on the same goal targets among programs? (2) Were efficiency measures based on the same cost items and same proration methods among programs? (3) Were there common characteristics of the community and students among institutions?	

Utilizing Activity	Remark
1.5 Interpret cost-benefit measures. Interpret cost-benefit measures as external efficiency indicators. The measures provide the following investment criteria for the programs: (1) The net present value of increased incomes indicates the difference between the benefit and costs. (2) The cost-benefit ratio indicates the degree of the benefits over the costs. (3) The internal rate of return indicates how much the benefits are derived over the interest rate.	

Utilizing Activity	Remark
2. <i>Develop conclusions and recommendations for the program.</i>	Conclusions and recommendations can be developed on the basis of the results and interpretation.
2.1 Draw conclusions from the results. Use the analytical study to draw conclusions on the following questions: (1) How effective is the program? (2) How efficient is the program? (3) What is the relationship between program effectiveness and cost efficiency? Furthermore, when comparing programs, draw conclusions on: (1) Which program is most effective among the studied programs? (2) Which program is most efficient? (3) Which program is most effective <u>and</u> efficient? 2.2 Develop recommendations for further actions. Based on the conclusions, recommendations such as these can be made for further action: (1) Increase program effectiveness, with the given resources.	

Utilizing Activity	Remark
(2) Increase cost efficiency.	
(3) Allocate additional resources to most effective and/or efficient programs.	
(4) Develop new alternate programs.	
2.3 Discuss conclusions and recommendations among the concerned people. Discuss the conclusions and recommendations among the concerned people and refer them to the advisory committee.	

Utilizing Activity	Remark
3. Prepare a study report.	Throughout the discussion of the results, conclusions, and recommendations, a final report should be prepared for the decision-makers.
3.1 Review the planning and implementing activities. Review the planning and implementing activities and use them as a basis to organize the report. 3.2 Prepare the study report. The report will include: (1) Objectives of the study (2) Procedures for the study (3) Program objectives and target goals (4) Actual outputs from the program (5) Program costs (6) Cost-effectiveness and/or cost-benefit measures (7) Conclusions and recommendations	

- B. *How can the results be utilized for the evaluation, development, planning of the postsecondary occupational program?*

• Utilization of the Results from the Study

Based upon the recommendations made by the study team, use cost-effectiveness/benefit measures in evaluating existing programs, developing new alternative programs, and planning the overall program's improvement.

4. *Use the results for program evaluation.*

Evaluate the existing program in terms of program effectiveness, cost efficiency and performance.

5. *Use the results for program development.*

Use cost-effectiveness/benefit measures in revising existing programs or developing alternate programs.

6. *Use the results for program planning.*

Use cost-effectiveness/benefit measures in making short or long-range plans for the development of occupational programs.

Utilizing Activity	Remark
4. <i>Use the results for program evaluation.</i>	Cost-effectiveness/benefit measures can be used for ranking programs in order and developing strategies for increasing effectiveness and/or efficiency.
4.1 Rank programs in order. Use relative judgments on program effectiveness, cost efficiency, and/or management performance to rank programs in order. 4.2 Identify factors influencing program costs and explain the relationship between program effectiveness and costs. 4.3 Develop strategies for increasing effectiveness and/or efficiency. Make a final decision to develop strategies for increasing program effectiveness and/or cost efficiency.	

Utilizing Activity	Remark
5. Use the results for program development.	Cost-effectiveness/benefit measures can be used for modifying existing programs or developing new programs.
5.1 Make a judgment on the need for modifying existing programs. If a program is found to be very ineffective and inefficient, make a judgment which determines if the program should be modified or deleted. 5.2 Develop strategies for modifying the program or identifying a new alternate program. Make a final decision to develop strategies either modifying the program or developing a new alternate program.	

Utilizing Activity	Remark
6. <i>Use the results for program planning.</i>	Cost-effectiveness/benefit measures can be used for developing short and long-range plans.
6.1 Develop a short-range plan for minor change and improvement in the postsecondary vocational education. Based on the decision pertaining to program evaluation, develop a short-range plan for increasing program effectiveness and/or cost efficiency. 6.2 Develop a long-range plan for the improvement of overall vocational programs. Make a long-range plan to implement developmental strategies for the improvement of overall vocational programs as well as to develop new alternate programs from long-term perspectives.	

CHAPTER VI

CONCLUSIONS AND FURTHER SUGGESTIONS

A. *What are the concluding remarks?*

• Concluding Remarks

The manual is developed to provide a user-oriented guide to conducting cost-effectiveness/benefit studies for the evaluation, development, and planning of postsecondary vocational programs.

In using the manual, the following points should be noted:

1. Administrative awareness and commitment to cost-effectiveness/benefit analysis of occupational programs is a key to the success of the analysis.
2. Through discussion of needs and the scope of the analysis and appropriate resources, a study plan should be developed to include a specific design and a time schedule.
3. In determining program objectives/target goals, social demand and support and student characteristics information should be fully considered, and concerned people should be involved in the decision-making process.
4. Program costs should be accounted and analyzed in detail according to a standardized accounting system when comparing program costs among occupational programs.
5. Cost-effectiveness/benefit measures, as they appear in the manual, are relatively inclusive criteria for evaluating program effectiveness and cost efficiency. The measures must not be used as absolutely exclusive criteria in the decision-making process.
6. Cost-effectiveness/benefit studies should be repeated as a recycling process. Recurrent studies based on accumulated data will increase the utility of the results.

B. *What are further suggestions for using the manual?*

• Further Suggestions

Although the manual is designed to assist postsecondary vocational administrators, its use can be extended to all educational program evaluation and planning. The manual can be also improved by cumulated research efforts.

1. Even though the manual is focused on postsecondary vocational programs, the basic conceptual and analytical procedures can be applied to all educational programs as well.
2. As an example for cost-effectiveness/benefit analysis, the manual can be used in training prospective vocational administrators as well as for in-service administrators' workshops.
3. Additional research will be needed for defining program objectives and standardizing a cost analysis scheme. Based upon the cumulated research efforts, the manual will be improved for general use.

APPENDICES

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APPENDIX A

OBJECTIVES AND TARGET GOAL STATEMENTS FOR
THE POSTSECONDARY OCCUPATIONAL PROGRAMS

OBJECTIVE 1. *Students will be enrolled in the postsecondary occupational program to meet their educational needs.* TARGET GOALS are:

- 1-a. ____ (a total number of) students will be enrolled in the occupational program.
- 1-b. ____ percent of the enrollments will include disadvantaged students.
- 1-c. ____ percent of the enrollments will include handicapped students.
- 1-d. ____ percent of male or female students will be enrolled in the program traditionally considered sex-stereotyped.

OBJECTIVE 2. *Students enrolled in the postsecondary occupational program will complete the requirements of the program and be prepared for career development.* TARGET GOALS are:

- 2-a. ____ percent of enrollments will receive available information and services for career preparation.
- 2-b. ____ percent of enrollments will complete the program requirements by passing appropriate occupational competency tests.
- 2-c. ____ percent of enrollments will receive a certificate or associate degree relating to the program.
- 2-d. ____ percent of enrollments will pass licensure examinations relating to the specific program.

OBJECTIVE 3. *Program completers will be placed according to their training in jobs which will meet manpower demands.* TARGET GOALS are:

- 3-a. ____ percent of completers having sought employment will be placed within six months after completing the program.
(Consider military and apprenticeship as employed).
- 3-b. ____ percent of completers available for employment will be placed in their specialization in six months after completion.
- 3-c. ____ percent of completers available for employment will be placed in a job position as related to program in six months after completion.

APPENDIX A, continued

- 3-d. ____ percent of completers available for employment will find a job in six months after completion which meets manpower needs within the state.
- 3-e. ____ percent of completers available for employment will find a job in six months after completion to meet manpower needs outside the state.
- 3-f. ____ percent of employed completers will be rated as satisfactory in job skills by the employer.
- 3-g. ____ percent of employed completers will be rated as satisfactory in personal and social skills by the employer.

OBJECTIVE 4. *Some students will elect advanced studies after completion of the program.* TARGET GOALS are:

- 4-a. ____ percent of the graduates will be enrolled in advanced study programs.
- 4-b. ____ percent of the students enrolled in advanced study programs will be in an equivalent program specialty.
- 4-c. ____ percent of the students enrolled in advanced study programs will be in an allied program.
- 4-d. ____ percent of the students enrolled in advanced study programs will rate their previous program as helpful or a sound foundation to continue their advanced studies.

OBJECTIVE 5. *Program completers will increase their job satisfaction, status, and economic benefits.* TARGET GOALS are:

- 5-a. ____ percent of employed completers will report high job satisfaction.
- 5-b. ____ percent of employed completers will report salary increases related to previous training in the program.
- 5-c. ____ percent of employed completers will report job advancement related to the previous training in the program.
- 5-d. ____ increased earnings (net income) made by the individual will be related to the training in the programs.
- 5-e. ____ increased benefits (gross income) gained by the society will result from the training in the program.

APPENDIX B

DATA FORM FOR DETERMINING THE
PROGRAM TARGET GOALS AND OUTPUTS

<u>Program Objective</u>	<u>Factor Unit</u>	<u>Basic Unit</u>	<u>Goal or Output</u>
1-a.	# of total enrollments		
			=
1-b.	# of disadvantaged students	# of total enrollments	
			÷ x 100 = %
1-c.	# of handicapped students	# of total enrollments	
			÷ x 100 = %
1-d.	# of male or female students	# of total enrollments	
			÷ x 100 = %
2-a.	# of students who receive career information	# of total enrollments	
			÷ x 100 = %
2-b.	# of students who complete program requirements	# of total enrollments	
			÷ x 100 = %

APPENDIX B, continued

DATA UNIT

<u>Program Objective</u>	<u>Factor Unit</u>		<u>Basic Unit</u>		<u>Goal or Output</u>
2-c. # of students who receive a degree		÷		x 100 =	
2-d. # of students who pass licensure examinations		÷		x 100 =	
3-a. # of completers employed		÷		x 100 =	
3-b. # of completers placed in specialization		÷		x 100 =	
3-c. # of completers placed in related jobs		÷		x 100 =	
3-d. # of completers employed within state		÷		x 100 =	
3-e. # of completers employed outside the state		÷		x 100 =	

APPENDIX B, *continued*DATA UNIT

<u>Program Objective</u>	<u>Factor Unit</u>	<u>Basic Unit</u>	<u>Goal or Output</u>
3-f. # of employed completers whose job skills satisfy employers			$\div$ $\times 100 =$
3-g. # of employed completers whose personal and social skills satisfy employers			$\div$ $\times 100 =$
4-a. # of completers enrolled in advanced studies			$\div$ $\times 100 =$
4-b. # of completers enrolled in a specialty equivalent to previous studies			$\div$ $\times 100 =$
4-c. # of completers enrolled in a program allied to previous studies			$\div$ $\times 100 =$
4-d. # of enrolled completers who rate the previous program as a sound foundation for advanced studies			$\div$ $\times 100 =$

APPENDIX B, continued

DATA UNIT

<u>Program Objective</u>	<u>Factor Unit</u>		<u>Basic Unit</u>		<u>Goal or Output</u>
5-a. # of employed completers who report high job satisfaction		÷		x 100 =	
5-b. # of employed completers who report salary increases related to previous training		÷		x 100 =	
5-c. # of employed completers who report job advancement related to previous training		÷		x 100 =	
5-d. Average of employed completers' earnings (net incomes)		-		= \$	
5-e. Average of completers' earnings including taxes (gross income)		-		= \$	

APPENDIX C DATA FORM FOR PROGRAM COST ANALYSIS

<u>Cost Item and Procedure</u>	<u>Expected</u>	<u>Expended</u>
1. Annual salary of teaching staff	\$ _____	\$ _____
2. Fringe benefits for teaching staff	\$ _____	\$ _____
3. Purchased services	\$ _____	\$ _____
4. Instructional supplies and materials	\$ _____	\$ _____
5. Instructional equipment (annually depreciated)	\$ _____	\$ _____
*6. Instructional space use	\$ _____	\$ _____
a. Total building space	_____ sq. ft.	
b. Instructional space for the vocational program	_____ sq. ft.	
c. % instructional space for the program (b÷a)	_____ %	
d. % time in use for the vocational program	_____ %	
e. Time/floor unit (cxd)	_____ %	
f. Original building cost	\$ _____	
g. Life expectancy	_____ years	
h. Total annual depreciated cost (f÷g)	\$ _____	
i. Annual depreciated cost for the program (cxh)	\$ _____	
7. Direct Costs - total (Adding 1-6)	\$ _____	\$ _____
8. Departmental administration and support services - total	\$ _____	\$ _____
9. % FTE students enrolled in the program	_____ %	
10. Prorated departmental cost (8x9)	\$ _____	\$ _____

APPENDIX C, continued

<u>Cost Item and Procedure</u>	<u>Expected</u>	<u>Expended</u>
11. College administration and support services - total	\$ _____	\$ _____
12. % FTE faculty in the program	_____	_____
13. Prorated college level costs (11x12)	\$ _____	\$ _____
14. Institutional administration - total	\$ _____	\$ _____
15. Prorated institutional administration costs (14x12)	\$ _____	\$ _____
16. Library and student services - total	\$ _____	\$ _____
17. Prorated library and student service costs (16x9)	\$ _____	\$ _____
18. Plant operation and maintenance - total	\$ _____	\$ _____
19. Prorated plant operation and maintenance costs (18x6e)	\$ _____	\$ _____
20. Auxiliary services for faculty - total	\$ _____	\$ _____
21. Prorated faculty auxiliary costs (20x12)	\$ _____	\$ _____
22. Auxiliary services for student - total	\$ _____	\$ _____
23. Prorated student auxiliary cost (22x9)	\$ _____	\$ _____
24. Indirect Costs - total (10+13+15+17+19+21+23)	\$ _____	\$ _____
25. Total program costs (7+24)	\$ _____	\$ _____
26. Total number of FTE students enrolled in the program	_____	_____

APPENDIX C, continued

<u>Cost Item and Procedure</u>	<u>Expected</u>	<u>Expended</u>
27. Total number student credit hours in the program	_____	_____
28. Total number of program completers	_____	_____
29. Unit cost per student (25 ÷ 26)	\$ _____	\$ _____
30. Unit cost per student credit hour (25 ÷ 27)	\$ _____	\$ _____
31. Unit cost per completer (25 ÷ 28)	\$ _____	\$ _____

-
- * Costs for instructional space use are optional when accounting for direct costs. When evaluating an individual program or comparing more than two programs within an institution, it may not be necessary to consider the capital outlays. However, if the analysis is directed to making decisions pertaining to comparison of vocational programs between institutions, or to selection of new programs which may need new space acquisitions, then capital costs must be considered.

APPENDIX D TABLES FOR COMPUTING COST-BENEFIT MEASURES

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59. . . . D-2 : TABLE FOR INTEREST RATES: $(1+r)^t$
60. . . . D-3 : TABLE FOR DISCOUNT RATES: $\frac{1}{(1+r)^t}$ or $(1+r)^{-t}$
61. . . . D-4 : TABLE OF CUMULATIVE SUM OF RATIOS OF INCOME GROWTH RATE
TO INTEREST RATES: $\sum_{t=1}^n \frac{(1+k)^{t-1}}{(1+r)^t}$, WHEN $k=3$
62. . . . D-5 : TABLE OF CUMULATIVE SUM OF RATIOS OF INCOME GROWTH RATE
TO INTEREST RATES: $\sum_{t=1}^n \frac{(1+k)^{t-1}}{(1+r)^t}$, WHEN $k=4$
63. . . . D-6 : TABLE OF CUMULATIVE SUM OF RATIOS OF INCOME GROWTH RATE
TO INTEREST RATES: $\sum_{t=1}^n \frac{(1+k)^{t-1}}{(1+r)^t}$, WHEN $k=5$
64. . . . D-7 : TABLE OF CUMULATIVE SUM OF RATIOS OF INCOME GROWTH RATE
TO INTEREST RATES: $\sum_{t=1}^n \frac{(1+k)^{t-1}}{(1+r)^t}$, WHEN $k=6$

APPENDIX D-1

TABLE FOR ANNUAL INCOME GROWTH RATES: $(1+k)^t$

Yr.	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%
1.	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2.	1.0100	1.0200	1.0300	1.0400	1.0500	1.0600	1.0700	1.0800	1.0900	1.1000	1.1100	1.1200	1.1300	1.1400	1.1500
3.	1.0201	1.0404	1.0609	1.0816	1.1025	1.1236	1.1449	1.1664	1.1881	1.2100	1.2321	1.2544	1.2769	1.2996	1.3225
4.	1.0303	1.0612	1.0927	1.1249	1.1576	1.1910	1.2250	1.2597	1.2950	1.3310	1.3676	1.4049	1.4429	1.4815	1.5209
5.	1.0406	1.0824	1.1255	1.1699	1.2155	1.2625	1.3100	1.3605	1.4116	1.4641	1.5181	1.5735	1.6305	1.6890	1.7490
6.	1.0510	1.1041	1.1593	1.2167	1.2763	1.3382	1.4026	1.4693	1.5386	1.6105	1.6851	1.7623	1.8429	1.9254	2.0114
7.	1.0615	1.1262	1.1941	1.2653	1.3401	1.4185	1.5007	1.5869	1.6771	1.7716	1.8704	1.9738	2.0820	2.1950	2.3131
8.	1.0721	1.1487	1.2299	1.3159	1.4071	1.5036	1.6058	1.7138	1.8280	1.9487	2.0762	2.2107	2.3526	2.5023	2.6600
9.	1.0829	1.1717	1.2668	1.3686	1.4775	1.5938	1.7182	1.8509	1.9926	2.1436	2.3045	2.4769	2.6589	2.8526	3.0590
10.	1.0937	1.1951	1.3048	1.4233	1.5513	1.6895	1.8385	1.9990	2.1719	2.3579	2.5580	2.7731	3.0040	3.2519	3.5179
11.	1.1046	1.2190	1.3439	1.4802	1.6289	1.7908	1.9672	2.1589	2.3674	2.5937	2.8394	3.1058	3.3946	3.7072	4.0456
12.	1.1157	1.2434	1.3842	1.5395	1.7103	1.8983	2.1049	2.3316	2.5894	2.8531	3.1318	3.4275	3.7429	4.0894	4.4684
13.	1.1268	1.2682	1.4258	1.6010	1.7959	2.0122	2.2522	2.5182	2.8127	3.1384	3.4985	3.8960	4.3345	4.8179	5.3503
14.	1.1381	1.2936	1.4685	1.6651	1.8856	2.1329	2.4098	2.7196	3.0658	3.4523	3.8833	4.3635	4.8980	5.4924	6.1528
15.	1.1495	1.3175	1.5126	1.7317	1.9799	2.2602	2.5785	2.9372	3.3417	3.7975	4.3104	4.8871	5.5348	6.2613	7.0757
16.	1.1610	1.3459	1.5580	1.8009	2.0789	2.3966	2.7590	3.1722	3.6425	4.1772	4.7846	5.4736	6.2543	7.1379	8.1371
17.	1.1726	1.3728	1.6047	1.8730	2.1829	2.5404	2.9522	3.4259	3.9703	4.5950	5.3109	6.1304	7.0673	8.1372	9.3576
18.	1.1843	1.4002	1.6528	1.9479	2.2920	2.6928	3.1588	3.7000	4.3276	5.0595	5.8951	6.8668	7.9861	9.2765	10.7613
19.	1.1961	1.4282	1.7024	2.0258	2.4066	2.8543	3.3799	3.9960	4.7171	5.5599	6.5436	7.6900	9.0243	10.5752	12.3755
20.	1.2081	1.4568	1.7535	2.1068	2.5270	3.0256	3.6165	4.3157	5.1417	6.1159	7.2633	8.6128	10.1974	12.0557	14.2318
21.	1.2202	1.4859	1.8061	2.1911	2.6533	3.2071	3.8697	4.6610	5.6094	6.7275	8.0623	9.6463	11.5231	13.7435	16.3665
22.	1.2324	1.5157	1.8603	2.2788	2.7860	3.3996	4.1406	5.0338	6.1088	7.4002	8.9492	10.8038	13.0211	15.6676	18.8215
23.	1.2447	1.5460	1.9161	2.3699	2.9253	3.6035	4.4304	5.4365	6.6586	8.1403	9.9336	12.1083	14.7138	17.8610	21.6447
24.	1.2572	1.5769	1.9736	2.4647	3.0715	3.8197	4.7405	5.8715	7.2572	8.9593	11.0263	13.5523	16.6266	20.3616	24.8915
25.	1.2697	1.6084	2.0328	2.5633	3.2251	4.0489	5.0724	6.3412	7.9111	9.8497	12.2392	15.1786	18.7881	23.2122	28.6252
26.	1.2824	1.6406	2.0938	2.6658	3.3864	4.2919	5.4274	6.8485	8.6231	10.8347	13.5855	17.0001	21.2305	26.4619	32.9190
27.	1.2953	1.6735	2.1566	2.7725	3.5557	4.5494	5.8074	7.3264	9.3992	11.9182	15.0729	19.0401	23.7205	30.1666	37.8568
28.	1.3082	1.7069	2.2213	2.8834	3.7335	4.8223	6.2139	7.9881	10.2491	13.1100	16.7386	21.3249	27.1093	34.3899	43.5353
29.	1.3213	1.7410	2.2879	2.9987	3.9201	5.1117	6.6488	8.6271	11.1671	14.4210	18.5799	23.8839	30.6335	39.2045	50.0656
30.	1.3345	1.7756	2.3566	3.1187	4.1161	5.4184	7.1193	9.3173	12.1722	15.8631	20.6237	26.7422	34.6158	44.6931	57.5755
31.	1.3478	1.8114	2.4273	3.2434	4.3219	5.7435	7.6123	10.0627	13.2677	17.4494	22.8923	29.8599	39.1159	50.9502	66.2118
32.	1.3613	1.8476	2.5001	3.3731	4.5380	6.0861	8.1451	10.8677	14.4618	19.1943	25.4104	33.5551	44.2010	58.0832	76.1435
33.	1.3749	1.8845	2.5751	3.5081	4.7647	6.4534	8.7153	11.7371	15.7633	21.1138	28.2056	37.5817	49.2471	66.2148	87.5651
34.	1.3887	1.9222	2.6523	3.6484	5.0032	6.8406	9.3253	12.6760	17.1820	23.2252	31.3082	42.0915	56.4402	75.4649	100.6998
35.	1.4026	1.9607	2.7319	3.7943	5.2533	7.2510	9.9781	13.6901	18.7284	25.5477	34.7521	47.1425	63.7774	86.0528	115.8048
36.	1.4166	1.9999	2.8139	3.9461	5.5160	7.6861	10.6766	14.7853	20.4140	28.1029	38.5749	52.7296	72.0685	98.1002	133.1755
37.	1.4308	2.0399	2.8983	4.1039	5.7918	8.1473	11.4239	15.9682	22.2512	30.9127	42.8181	59.1356	81.4374	111.8342	153.1519
38.	1.4451	2.0807	2.9852	4.2681	6.0814	8.6361	12.2236	17.2456	24.2538	34.0039	47.5281	66.2318	92.0243	127.4910	176.1246
39.	1.4595	2.1223	3.0748	4.4388	6.3855	9.1543	13.0793	18.6253	26.4367	37.4043	52.7562	74.1797	103.2874	145.3397	202.5433
40.	1.4741	2.1647	3.1674	4.6164	6.7048	9.7035	13.9928	20.1153	28.8160	41.1448	58.5593	83.0812	117.0258	165.6871	232.9248

APPENDIX D-2

TABLE FOR INTEREST RATES: $(1+r)^t$

Yr.	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%
1.	1.0100	1.0200	1.0300	1.0400	1.0500	1.0600	1.0700	1.0800	1.0900	1.1000	1.1100	1.1200	1.1300	1.1400	1.1500
2.	1.0201	1.0404	1.0609	1.0816	1.1025	1.1236	1.1447	1.1660	1.1875	1.2091	1.2308	1.2526	1.2745	1.2965	1.3185
3.	1.0303	1.0612	1.0927	1.1247	1.1576	1.1910	1.2250	1.2597	1.2950	1.3309	1.3673	1.4043	1.4418	1.4798	1.5179
4.	1.0406	1.0824	1.1255	1.1699	1.2155	1.2625	1.3108	1.3605	1.4116	1.4641	1.5181	1.5735	1.6305	1.6890	1.7490
5.	1.0510	1.1041	1.1593	1.2167	1.2763	1.3382	1.4026	1.4693	1.5386	1.6105	1.6851	1.7623	1.8424	1.9254	2.0114
6.	1.0615	1.1262	1.1941	1.2653	1.3401	1.4185	1.5007	1.5869	1.6771	1.7716	1.8704	1.9738	2.0820	2.1950	2.3131
7.	1.0721	1.1487	1.2299	1.3159	1.4071	1.5036	1.6058	1.7138	1.8280	1.9487	2.0762	2.2107	2.3526	2.5023	2.6600
8.	1.0827	1.1717	1.2668	1.3686	1.4775	1.5938	1.7182	1.8509	1.9926	2.1436	2.3042	2.4760	2.6594	2.8552	3.0640
9.	1.0937	1.1951	1.3048	1.4233	1.5513	1.6895	1.8385	1.9990	2.1719	2.3579	2.5580	2.7731	3.0048	3.2519	3.5179
10.	1.1046	1.2190	1.3439	1.4802	1.6289	1.7908	1.9672	2.1589	2.3674	2.5937	2.8394	3.1058	3.3946	3.7072	4.0456
11.	1.1157	1.2353	1.3652	1.5123	1.6733	1.8493	2.0419	2.2516	2.4801	2.7291	3.0000	3.2945	3.6139	3.9598	4.3445
12.	1.1268	1.2532	1.3881	1.5432	1.7133	1.8993	2.1032	2.3262	2.5702	2.8361	3.1255	3.4405	3.7839	4.1585	4.5680
13.	1.1381	1.2696	1.4095	1.5737	1.7538	1.9498	2.1639	2.3982	2.6549	2.9351	3.2411	3.5755	3.9405	4.3385	4.7740
14.	1.1498	1.2819	1.4264	1.5957	1.7818	1.9808	2.1961	2.4298	2.6881	2.9721	3.2839	3.6265	3.9935	4.3985	4.8470
15.	1.1610	1.2959	1.4424	1.6123	1.8054	2.0175	2.2429	2.4838	2.7413	3.0165	3.3211	3.6575	4.0285	4.4375	4.8880
16.	1.1726	1.3128	1.4607	1.6320	1.8325	2.0500	2.2785	2.5222	2.7831	3.0621	3.3705	3.7105	4.0855	4.4995	4.9580
17.	1.1845	1.3302	1.4802	1.6537	1.8571	2.0765	2.3081	2.5548	2.8181	3.1001	3.4125	3.7575	4.1375	4.5565	5.0210
18.	1.1961	1.3482	1.5024	1.6773	1.8833	2.1050	2.3405	2.5912	2.8571	3.1421	3.4585	3.8075	4.1925	4.6175	5.0900
19.	1.2081	1.3668	1.5255	1.7029	1.9118	2.1365	2.3750	2.6307	2.9001	3.1861	3.5055	3.8575	4.2475	4.6775	5.1550
20.	1.2202	1.3859	1.5461	1.7241	1.9373	2.1690	2.4115	2.6712	2.9441	3.2371	3.5605	3.9155	4.3125	4.7475	5.2250
21.	1.2324	1.4057	1.5673	1.7463	1.9605	2.2025	2.4490	2.7127	2.9891	3.2841	3.6125	3.9705	4.3675	4.8075	5.2950
22.	1.2447	1.4260	1.5891	1.7695	1.9868	2.2370	2.4875	2.7552	3.0291	3.3171	3.6495	4.0075	4.4025	4.8475	5.3650
23.	1.2572	1.4469	1.6115	1.7937	2.0148	2.2725	2.5270	2.7977	3.0641	3.3511	3.6875	4.0405	4.4375	4.8825	5.4350
24.	1.2697	1.4684	1.6345	1.8189	2.0438	2.3090	2.5585	2.8302	3.1001	3.3841	3.7225	4.0775	4.4725	4.9175	5.5050
25.	1.2824	1.4906	1.6581	1.8451	2.0738	2.3415	2.5910	2.8637	3.1321	3.4171	3.7575	4.1125	4.5075	4.9525	5.5750
26.	1.2953	1.5135	1.6823	1.8713	2.1048	2.3750	2.6245	2.9002	3.1641	3.4511	3.7925	4.1475	4.5425	4.9875	5.6450
27.	1.3082	1.5369	1.7071	1.8985	2.1368	2.4090	2.6585	2.9362	3.1961	3.4841	3.8275	4.1825	4.5775	5.0225	5.7150
28.	1.3213	1.5608	1.7325	1.9269	2.1698	2.4445	2.6930	2.9727	3.2301	3.5171	3.8625	4.2175	4.6125	5.0575	5.7850
29.	1.3345	1.5852	1.7585	1.9561	2.2038	2.4800	2.7285	3.0092	3.2641	3.5511	3.8975	4.2525	4.6475	5.0925	5.8550
30.	1.3478	1.6101	1.7847	1.9873	2.2388	2.5165	2.7650	3.0467	3.2981	3.5841	3.9325	4.2875	4.6825	5.1275	5.9250
31.	1.3613	1.6356	1.8115	2.0195	2.2748	2.5540	2.8025	3.0842	3.3321	3.6171	3.9675	4.3225	4.7175	5.1625	6.0000
32.	1.3749	1.6617	1.8389	2.0527	2.3118	2.5925	2.8400	3.1227	3.3661	3.6511	3.9925	4.3575	4.7525	5.1975	6.0750
33.	1.3887	1.6884	1.8669	2.0869	2.3498	2.6320	2.8785	3.1622	3.4001	3.6841	4.0275	4.3925	4.7875	5.2325	6.1500
34.	1.4026	1.7157	1.8955	2.1221	2.3888	2.6745	2.9170	3.2027	3.4341	3.7171	4.0625	4.4275	4.8225	5.2675	6.2250
35.	1.4166	1.7436	1.9247	2.1583	2.4288	2.7180	2.9565	3.2452	3.4681	3.7511	4.0975	4.4625	4.8575	5.3025	6.3000
36.	1.4308	1.7721	1.9545	2.1955	2.4700	2.7605	2.9970	3.2867	3.5021	3.7841	4.1325	4.4975	4.8925	5.3375	6.3750
37.	1.4451	1.8012	1.9849	2.2327	2.5125	2.8040	3.0385	3.3282	3.5361	3.8171	4.1675	4.5325	4.9275	5.3725	6.4500
38.	1.4595	1.8309	2.0159	2.2709	2.5560	2.8475	3.0810	3.3707	3.5701	3.8511	4.2025	4.5675	4.9625	5.4075	6.5250
39.	1.4741	1.8612	2.0475	2.3091	2.6005	2.8920	3.1245	3.4132	3.6041	3.8841	4.2375	4.6025	4.9975	5.4425	6.6000
40.	1.4889	1.8921	2.0797	2.3483	2.6460	2.9395	3.1690	3.4567	3.6381	3.9171	4.2725	4.6375	5.0325	5.4775	6.6750

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TABLE FOR DISCOUNT RATES: $\frac{1}{(1+r)^t}$ or $(1+r)^{-t}$

Yr.	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%
1.	.9901	.9804	.9709	.9615	.9524	.9434	.9346	.9259	.9174	.9091	.9009	.8929	.8850	.8772	.8696
2.	.9803	.9612	.9426	.9246	.9070	.8900	.8734	.8573	.8417	.8264	.8116	.7972	.7831	.7695	.7561
3.	.9706	.9423	.9151	.8890	.8638	.8396	.8163	.7936	.7722	.7513	.7312	.7118	.6931	.6750	.6575
4.	.9610	.9238	.8885	.8549	.8227	.7921	.7629	.7350	.7084	.6830	.6587	.6355	.6133	.5921	.5718
5.	.9515	.9057	.8626	.8219	.7835	.7473	.7130	.6806	.6499	.6209	.5935	.5674	.5428	.5194	.4972
6.	.9420	.8880	.8375	.7903	.7462	.7050	.6663	.6302	.5963	.5645	.5346	.5066	.4803	.4556	.4323
7.	.9327	.8706	.8131	.7599	.7107	.6651	.6227	.5835	.5470	.5132	.4817	.4523	.4251	.3996	.3759
8.	.9235	.8535	.7894	.7307	.6768	.6274	.5820	.5403	.5019	.4665	.4339	.4039	.3762	.3506	.3269
9.	.9143	.8368	.7664	.7026	.6446	.5919	.5439	.5002	.4604	.4241	.3909	.3606	.3329	.3075	.2843
10.	.9053	.8203	.7441	.6756	.6137	.5584	.5083	.4632	.4224	.3855	.3522	.3220	.2946	.2697	.2472
11.	.8963	.8043	.7224	.6496	.5847	.5268	.4751	.4289	.3875	.3505	.3173	.2875	.2607	.2366	.2149
12.	.8874	.7885	.7014	.6246	.5568	.4970	.4440	.3971	.3555	.3186	.2858	.2567	.2307	.2076	.1869
13.	.8787	.7730	.6810	.6006	.5303	.4688	.4150	.3677	.3262	.2897	.2575	.2292	.2042	.1821	.1625
14.	.8700	.7579	.6611	.5775	.5051	.4423	.3878	.3405	.2992	.2633	.2320	.2046	.1807	.1597	.1413
15.	.8613	.7430	.6419	.5553	.4810	.4173	.3624	.3152	.2745	.2394	.2090	.1827	.1599	.1401	.1229
16.	.8528	.7284	.6232	.5339	.4581	.3936	.3387	.2919	.2519	.2176	.1883	.1631	.1415	.1229	.1069
17.	.8444	.7142	.6050	.5134	.4363	.3714	.3166	.2703	.2311	.1978	.1696	.1456	.1252	.1078	.0929
18.	.8360	.7002	.5874	.4936	.4155	.3503	.2959	.2502	.2120	.1799	.1528	.1300	.1108	.0946	.0808
19.	.8277	.6864	.5703	.4746	.3957	.3305	.2765	.2317	.1945	.1635	.1377	.1161	.0981	.0829	.0703
20.	.8195	.6730	.5537	.4564	.3769	.3118	.2584	.2145	.1784	.1486	.1240	.1037	.0868	.0728	.0611
21.	.8114	.6598	.5375	.4388	.3589	.2942	.2415	.1987	.1637	.1351	.1117	.0926	.0768	.0638	.0531
22.	.8034	.6468	.5219	.4220	.3418	.2775	.2257	.1839	.1502	.1228	.1007	.0826	.0680	.0560	.0462
23.	.7954	.6342	.5067	.4057	.3256	.2618	.2109	.1703	.1378	.1117	.0907	.0738	.0601	.0491	.0402
24.	.7876	.6217	.4919	.3901	.3101	.2470	.1971	.1577	.1264	.1015	.0817	.0659	.0532	.0431	.0349
25.	.7798	.6095	.4776	.3751	.2953	.2330	.1842	.1460	.1160	.0923	.0736	.0588	.0471	.0378	.0304
26.	.7720	.5976	.4637	.3607	.2812	.2198	.1722	.1352	.1064	.0839	.0663	.0525	.0417	.0331	.0264
27.	.7644	.5859	.4502	.3468	.2678	.2074	.1609	.1252	.0976	.0763	.0597	.0469	.0369	.0291	.0230
28.	.7568	.5744	.4371	.3335	.2551	.1956	.1504	.1159	.0895	.0693	.0538	.0419	.0326	.0255	.0200
29.	.7493	.5631	.4243	.3207	.2429	.1846	.1406	.1073	.0822	.0630	.0485	.0374	.0289	.0224	.0174
30.	.7419	.5521	.4120	.3083	.2314	.1741	.1314	.0994	.0754	.0573	.0437	.0334	.0256	.0196	.0151
31.	.7346	.5412	.4000	.2965	.2204	.1643	.1228	.0920	.0691	.0521	.0394	.0298	.0226	.0172	.0131
32.	.7273	.5306	.3883	.2851	.2099	.1550	.1147	.0852	.0634	.0474	.0355	.0266	.0200	.0151	.0114
33.	.7201	.5202	.3778	.2741	.1999	.1462	.1072	.0789	.0582	.0431	.0319	.0238	.0177	.0132	.0099
34.	.7130	.5100	.3660	.2636	.1904	.1379	.1002	.0730	.0534	.0391	.0288	.0212	.0157	.0116	.0086
35.	.7059	.5000	.3554	.2534	.1813	.1301	.0937	.0676	.0490	.0356	.0259	.0189	.0139	.0102	.0075
36.	.6989	.4902	.3450	.2437	.1727	.1227	.0875	.0626	.0449	.0323	.0234	.0169	.0123	.0089	.0065
37.	.6920	.4806	.3350	.2343	.1644	.1150	.0818	.0580	.0412	.0294	.0210	.0151	.0109	.0078	.0057
38.	.6852	.4712	.3252	.2253	.1566	.1092	.0765	.0537	.0378	.0267	.0190	.0135	.0096	.0069	.0049
39.	.6784	.4619	.3158	.2166	.1491	.1031	.0715	.0497	.0347	.0243	.0171	.0120	.0085	.0060	.0043
40.	.6717	.4524	.3066	.2083	.1420	.0972	.0668	.0468	.0318	.0221	.0154	.0101	.0072	.0053	.0037

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APPENDIX D-4

TABLE OF CUMULATIVE SUM OF RATIOS OF
 $\sum_{t=1}^n \frac{(1+k)^{t-1}}{(1+r)^t}$, WHEN $k=3$
 INCOME GROWTH RATE TO INTEREST RATES:

Yr.	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%
1.	.990	.980	.971	.962	.952	.943	.935	.926	.917	.909	.901	.893	.885	.877	.870
2.	2.000	1.970	1.942	1.914	1.887	1.860	1.834	1.809	1.785	1.760	1.737	1.714	1.692	1.670	1.648
3.	3.030	2.970	2.913	2.857	2.803	2.751	2.700	2.651	2.604	2.557	2.513	2.469	2.427	2.386	2.346
4.	4.080	3.980	3.883	3.791	3.702	3.616	3.534	3.454	3.378	3.304	3.232	3.164	3.097	3.033	2.971
5.	5.150	4.999	4.854	4.716	4.584	4.457	4.336	4.220	4.109	4.003	3.900	3.802	3.708	3.617	3.530
6.	6.243	6.028	5.825	5.632	5.449	5.275	5.109	4.951	4.800	4.657	4.520	4.390	4.265	4.146	4.031
7.	7.356	7.068	6.796	6.540	6.298	6.069	5.852	5.648	5.454	5.270	5.095	4.930	4.772	4.623	4.480
8.	8.492	8.118	7.767	7.438	7.130	6.840	6.568	6.312	6.071	5.843	5.629	5.426	5.235	5.054	4.882
9.	9.650	9.178	8.738	8.328	7.947	7.590	7.257	6.946	6.654	6.381	6.124	5.883	5.657	5.443	5.243
10.	10.831	10.248	9.709	9.210	8.748	8.319	7.921	7.550	7.205	6.884	6.584	6.303	6.041	5.795	5.565
11.	12.036	11.329	10.680	10.083	9.533	9.027	8.559	8.127	7.726	7.355	7.010	6.690	6.391	6.113	5.854
12.	13.265	12.420	11.650	10.947	10.304	9.715	9.174	8.676	8.210	7.796	7.406	7.045	6.711	6.401	6.113
13.	14.517	13.522	12.621	11.804	11.060	10.383	9.765	9.200	8.683	8.209	7.773	7.372	7.002	6.660	6.344
14.	15.795	14.635	13.592	12.652	11.882	11.233	10.635	10.080	9.569	9.123	8.696	8.284	7.883	7.495	7.127
15.	17.098	15.759	14.563	13.492	12.530	11.664	10.883	10.177	9.538	8.958	8.430	7.949	7.509	7.107	6.738
16.	18.426	16.894	15.534	14.323	13.243	12.277	11.411	10.632	9.930	9.297	8.723	8.203	7.729	7.298	6.904
17.	19.781	18.040	16.503	15.147	13.943	12.873	11.919	11.066	10.301	9.614	8.995	8.436	7.930	7.471	7.053
18.	21.163	19.197	17.476	15.963	14.630	13.452	12.488	11.679	10.952	9.911	9.248	8.651	8.113	7.627	7.187
19.	22.572	20.366	18.447	16.771	15.304	14.015	12.879	11.874	10.983	9.910	9.182	8.549	8.000	7.469	7.007
20.	24.009	21.546	19.417	17.571	15.965	14.562	13.332	12.250	11.296	10.450	9.700	9.031	8.433	7.896	7.414
21.	25.475	22.734	20.388	18.364	16.613	15.093	13.768	12.609	11.591	10.695	9.902	9.198	8.571	8.011	7.510
22.	26.970	23.941	21.359	19.149	17.249	15.609	14.188	12.951	11.871	10.923	10.089	9.352	8.698	8.116	7.596
23.	28.494	25.156	22.330	19.926	17.873	16.111	14.592	13.277	12.135	11.137	10.263	9.493	8.813	8.210	7.673
24.	30.040	26.383	23.301	20.696	18.465	16.598	14.981	13.589	12.384	11.337	10.424	9.623	8.918	8.295	7.742
25.	31.635	27.622	24.272	21.459	19.085	17.072	15.356	13.885	12.620	11.525	10.574	9.743	9.014	8.372	7.803
26.	33.250	28.873	25.243	22.214	19.674	17.532	15.716	14.169	12.843	11.701	10.712	9.853	9.101	8.441	7.859
27.	34.898	30.137	26.214	22.962	20.252	17.979	16.063	14.438	13.053	11.865	10.841	9.954	9.181	8.504	7.908
28.	36.579	31.413	27.184	23.703	20.818	18.414	16.397	14.696	13.252	12.019	10.961	10.047	9.253	8.560	7.953
29.	38.294	32.701	28.155	24.436	21.374	18.836	16.719	14.942	13.440	12.163	11.072	10.132	9.319	8.612	7.992
30.	40.042	34.002	29.126	25.163	21.919	19.246	17.026	15.176	13.618	12.299	11.175	10.211	9.379	8.658	8.028
31.	41.825	35.316	30.097	25.883	22.454	19.645	17.326	15.399	13.785	12.425	11.270	10.283	9.434	8.700	8.060
32.	43.643	36.642	31.066	26.595	22.979	20.032	17.613	15.612	13.944	12.543	11.359	10.350	9.484	8.737	8.088
33.	45.498	37.982	32.039	27.301	23.494	20.409	17.889	15.815	14.094	12.654	11.441	10.411	9.530	8.771	8.114
34.	47.389	39.335	33.010	28.000	23.998	20.775	18.155	16.009	14.236	12.758	11.517	10.467	9.572	8.802	8.137
35.	49.317	40.701	33.981	28.622	24.494	21.130	18.411	16.174	14.369	12.855	11.588	10.512	9.610	8.830	8.157
36.	51.284	42.080	34.951	29.378	24.980	21.475	18.657	16.370	14.496	12.946	11.654	10.567	9.644	8.855	8.176
37.	53.290	43.473	35.922	30.057	25.456	21.811	18.895	16.538	14.615	13.032	11.715	10.610	9.676	8.878	8.192
38.	55.335	44.880	36.893	30.730	25.924	22.137	19.123	16.690	14.728	13.111	11.771	10.651	9.704	8.899	8.207
39.	57.421	46.300	37.864	31.396	26.382	22.454	19.343	16.851	14.835	13.186	11.824	10.688	9.730	8.917	8.220
40.	59.548	47.735	38.835	32.055	26.832	22.762	19.554	16.997	14.936	13.256	11.873	10.722	9.754	8.934	8.232

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TABLE OF CUMULATIVE SUM OF RATIOS OF
INCOME GROWTH RATE TO INTEREST RATES: $\sum_{t=1}^n \frac{(1+k)^{t-1}}{(1+r)^t}$, WHEN $k=4$

Yr.	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%
1.	.990	.980	.971	.962	.952	.943	.935	.926	.917	.909	.901	.893	.885	.877	.870
2.	2.010	1.980	1.951	1.923	1.894	1.869	1.843	1.818	1.793	1.769	1.745	1.722	1.699	1.677	1.656
3.	3.039	2.999	2.941	2.885	2.830	2.777	2.726	2.676	2.628	2.581	2.536	2.492	2.449	2.407	2.367
4.	4.140	4.038	3.940	3.846	3.755	3.666	3.584	3.503	3.425	3.350	3.277	3.207	3.139	3.073	3.010
5.	5.253	5.098	4.950	4.806	4.672	4.542	4.418	4.299	4.185	4.076	3.971	3.870	3.774	3.681	3.592
6.	6.390	6.178	5.968	5.762	5.580	5.400	5.229	5.066	4.911	4.763	4.622	4.487	4.358	4.235	4.118
7.	7.560	7.280	6.997	6.731	6.479	6.242	6.017	5.804	5.603	5.412	5.231	5.059	4.896	4.741	4.594
8.	8.795	8.403	8.036	7.692	7.370	7.067	6.783	6.515	6.263	6.026	5.802	5.591	5.391	5.202	5.024
9.	10.046	9.598	9.085	8.654	8.252	7.877	7.527	7.200	6.893	6.606	6.337	6.089	5.862	5.623	5.413
10.	11.335	10.716	10.144	9.615	9.126	8.672	8.251	7.859	7.495	7.155	6.838	6.543	6.266	6.007	5.765
11.	12.662	11.906	11.213	10.577	9.991	9.452	8.954	8.494	8.068	7.674	7.308	6.968	6.652	6.357	6.083
12.	14.028	13.120	12.293	11.538	10.849	10.217	9.637	9.105	8.616	8.164	7.748	7.363	7.007	6.677	6.371
13.	15.435	14.358	13.383	12.500	11.698	10.967	10.302	9.694	9.138	8.620	8.160	7.738	7.334	6.958	6.611
14.	16.883	15.620	14.484	13.462	12.539	11.704	10.948	10.261	9.636	9.067	8.547	8.071	7.635	7.234	6.866
15.	18.375	16.906	15.596	14.423	13.372	12.426	11.575	10.807	10.111	9.481	8.908	8.387	7.912	7.477	7.079
16.	19.911	18.218	16.718	15.385	14.197	13.135	12.185	11.332	10.565	9.873	9.248	8.681	8.166	7.698	7.271
17.	21.492	19.556	17.851	16.346	15.014	13.831	12.778	11.839	10.998	10.244	9.565	8.954	8.401	7.900	7.445
18.	23.121	20.920	18.995	17.308	15.823	14.513	13.354	12.324	11.411	10.594	9.863	9.207	8.617	8.084	7.603
19.	24.797	22.310	20.151	18.269	16.625	15.183	13.915	12.795	11.805	10.925	10.142	9.442	8.815	8.252	7.745
20.	26.524	23.728	21.317	19.231	17.419	15.840	14.459	13.247	12.181	11.238	10.403	9.661	8.998	8.406	7.874
21.	28.302	25.174	22.495	20.192	18.205	16.484	14.988	13.683	12.539	11.534	10.648	9.863	9.167	8.546	7.990
22.	30.133	26.648	23.684	21.154	18.984	17.117	15.503	14.102	12.882	11.814	10.877	10.052	9.321	8.673	8.096
23.	32.018	28.151	24.885	22.115	19.756	17.737	16.003	14.506	13.208	12.079	11.092	10.227	9.464	8.790	8.191
24.	33.959	29.683	26.098	23.077	20.520	18.346	16.488	14.894	13.520	12.329	11.294	10.389	9.595	8.896	8.277
25.	35.958	31.245	27.322	24.038	21.277	18.943	16.961	15.269	13.817	12.566	11.482	10.540	9.716	8.993	8.355
26.	38.016	32.839	28.558	25.000	22.027	19.529	17.420	15.629	14.101	12.790	11.659	10.688	9.827	9.081	8.425
27.	40.135	34.463	29.806	25.962	22.769	20.104	17.866	15.976	14.371	13.001	11.825	10.819	9.929	9.162	8.489
28.	42.318	36.119	31.066	26.923	23.505	20.668	18.300	16.310	14.629	13.201	11.980	10.931	10.023	9.235	8.546
29.	44.565	37.808	32.339	27.885	24.234	21.222	18.721	16.632	14.876	13.390	12.125	11.043	10.110	9.302	8.598
30.	46.878	39.529	33.624	28.846	24.955	21.765	19.131	16.942	15.111	13.569	12.262	11.147	10.190	9.363	8.646
31.	49.261	41.285	34.921	29.808	25.670	22.297	19.529	17.240	15.335	13.738	12.389	11.243	10.263	9.419	8.688
32.	51.714	43.075	36.231	30.769	26.379	22.820	19.916	17.528	15.549	13.897	12.509	11.333	10.331	9.470	8.727
33.	54.240	44.900	37.554	31.731	27.079	23.333	20.292	17.805	15.753	14.049	12.621	11.417	10.393	9.517	8.762
34.	56.842	46.760	38.889	32.692	27.773	23.836	20.658	18.071	15.948	14.191	12.726	11.494	10.450	9.559	8.793
35.	59.520	48.658	40.237	33.654	28.461	24.330	21.013	18.328	16.134	14.326	12.824	11.566	10.503	9.598	8.822
36.	62.278	50.592	41.599	34.615	29.143	24.814	21.359	18.575	16.311	14.454	12.916	11.635	10.551	9.633	8.847
37.	65.118	52.565	42.974	35.577	29.817	25.289	21.694	18.813	16.480	14.575	13.003	11.694	10.596	9.665	8.871
38.	68.042	54.576	44.362	36.538	30.486	25.755	22.021	19.042	16.642	14.689	13.084	11.762	10.637	9.695	8.892
39.	71.053	56.626	45.763	37.500	31.148	26.213	22.338	19.263	16.796	14.797	13.160	11.805	10.675	9.721	8.911
40.	74.154	58.717	47.179	38.462	31.804	26.662	22.646	19.475	16.943	14.899	13.231	11.855	10.709	9.746	8.928

APPENDIX D-6

TABLE OF CUMULATIVE SUM OF RATIOS OF

$$\sum_{t=1}^n \frac{(1+k)^{t-1}}{(1+r)^t}$$
, WHEN $k=5$
 INCOME GROWTH RATE TO INTEREST RATES:

Yr.	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%
1.	.990	.990	.971	.962	.952	.943	.935	.926	.917	.909	.901	.893	.885	.877	.870
2.	2.019	1.990	1.961	1.932	1.905	1.878	1.852	1.826	1.801	1.777	1.753	1.730	1.707	1.685	1.664
3.	3.089	3.029	2.970	2.912	2.857	2.804	2.752	2.701	2.653	2.605	2.559	2.515	2.471	2.429	2.388
4.	4.202	4.098	3.998	3.902	3.810	3.721	3.635	3.552	3.473	3.396	3.322	3.250	3.181	3.115	3.050
5.	5.358	5.199	5.047	4.901	4.762	4.629	4.501	4.379	4.263	4.151	4.043	3.940	3.841	3.746	3.655
6.	6.561	6.332	6.115	5.910	5.714	5.529	5.352	5.184	5.024	4.871	4.726	4.587	4.454	4.327	4.206
7.	7.811	7.494	7.205	6.928	6.667	6.420	6.186	5.966	5.757	5.559	5.371	5.193	5.024	4.863	4.710
8.	9.110	8.700	8.316	7.956	7.619	7.303	7.005	6.726	6.463	6.215	5.982	5.761	5.553	5.356	5.170
9.	10.461	9.936	9.448	8.994	8.571	8.177	7.809	7.465	7.143	6.842	6.559	6.294	6.045	5.811	5.590
10.	11.865	11.209	10.583	10.002	9.524	9.043	8.598	8.184	7.798	7.440	7.105	6.793	6.502	6.229	5.974
11.	13.325	12.519	11.779	11.100	10.476	9.901	9.372	8.882	8.430	8.011	7.622	7.262	6.926	6.614	6.324
12.	14.843	13.857	12.979	12.169	11.429	10.751	10.131	9.561	9.038	8.556	8.111	7.701	7.321	6.969	6.643
13.	16.421	15.256	14.202	13.247	12.361	11.523	10.746	10.022	9.344	8.706	8.112	7.608	7.296	6.935	6.605
14.	18.062	16.685	15.448	14.336	13.333	12.427	11.607	10.864	10.188	9.572	9.011	8.498	8.028	7.598	7.202
15.	19.767	18.156	16.719	15.436	14.286	13.254	12.325	11.488	10.731	10.046	9.425	8.860	8.345	7.875	7.445
16.	21.540	19.670	18.015	16.545	15.238	14.072	13.029	12.095	11.255	10.499	9.816	9.199	8.632	8.130	7.667
17.	23.383	21.229	19.335	17.666	16.190	14.883	13.720	12.685	11.759	10.931	10.187	9.517	8.912	8.366	7.870
18.	25.299	22.834	20.682	18.797	17.143	15.686	14.398	13.258	12.245	11.343	10.537	9.815	9.166	8.583	8.055
19.	27.291	24.486	22.054	19.940	18.025	16.401	15.044	13.816	12.713	11.736	10.868	10.094	9.402	8.782	8.224
20.	29.362	26.166	23.463	21.098	19.048	17.269	15.717	14.358	13.164	12.112	11.182	10.356	9.622	8.966	8.379
21.	31.515	27.937	24.880	22.257	20.000	18.049	16.358	14.885	13.599	12.471	11.478	10.602	9.826	9.135	8.520
22.	33.754	29.732	26.334	23.433	20.952	18.823	16.907	15.378	14.017	12.813	11.759	10.832	10.015	9.291	8.649
23.	36.080	31.594	27.816	24.620	21.905	19.588	17.604	15.896	14.420	13.140	12.024	11.048	10.191	9.435	8.766
24.	38.499	33.504	29.327	25.818	22.857	20.347	18.209	16.380	14.808	13.451	12.275	11.250	10.354	9.567	8.873
25.	41.014	35.470	30.867	27.028	23.810	21.098	18.803	16.851	15.182	13.742	12.512	11.440	10.506	9.689	8.971
26.	43.629	37.493	32.437	28.249	24.762	21.843	19.386	17.399	15.543	14.033	12.737	11.618	10.647	9.801	9.061
27.	46.347	39.576	34.038	29.482	25.714	22.580	19.959	17.754	15.890	14.304	12.949	11.785	10.779	9.905	9.142
28.	49.172	41.721	35.678	30.727	26.667	23.310	20.520	18.187	16.224	14.563	13.150	11.941	10.900	10.000	9.217
29.	52.110	43.928	37.333	31.984	27.619	24.034	21.071	18.608	16.546	14.810	13.340	12.068	11.014	10.088	9.285
30.	55.164	46.201	39.029	33.254	28.571	24.751	21.612	19.017	16.856	15.046	13.520	12.225	11.119	10.169	9.347
31.	58.332	48.540	40.758	34.535	29.524	25.461	22.143	19.414	17.155	15.271	13.690	12.354	11.217	10.243	9.404
32.	61.639	50.948	42.520	35.820	30.476	26.164	22.663	19.801	17.443	15.486	13.851	12.474	11.308	10.312	9.456
33.	65.070	53.427	44.317	37.134	31.429	26.860	23.174	20.177	17.720	15.692	14.003	12.588	11.392	10.375	9.503
34.	68.637	55.979	46.148	38.483	32.381	27.550	23.676	20.522	17.987	15.887	14.147	12.694	11.470	10.433	9.546
35.	72.246	58.605	48.015	39.784	33.333	28.234	24.168	20.898	18.245	16.074	14.283	12.793	11.543	10.486	9.586
36.	76.201	61.309	49.918	41.128	34.286	28.911	24.651	21.243	18.493	16.253	14.412	12.887	11.611	10.536	9.622
37.	80.209	64.093	51.858	42.515	35.238	29.581	25.124	21.579	18.731	16.423	14.534	12.974	11.674	10.581	9.655
38.	84.376	66.959	53.836	43.856	36.190	30.246	25.589	21.905	18.962	16.586	14.649	13.056	11.732	10.623	9.685
39.	88.707	69.908	55.852	45.239	37.143	30.904	26.046	22.223	19.183	16.741	14.758	13.133	11.787	10.661	9.712
40.	93.211	72.945	57.908	46.635	38.095	31.556	26.493	22.531	19.397	16.889	14.862	13.205	11.837	10.697	9.737

BEST COPY AVAILABLE

TABLE FOR CUMULATIVE SUM OF RATIOS OF
 $\sum_{t=1}^n \frac{(1+k)^{t-1}}{(1+r)^t}$, WHEN $k=6$
 INCOME GROWTH RATE TO INTEREST RATES:

Yr.	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%
1.	.990	.980	.971	.962	.952	.943	.935	.926	.917	.909	.901	.893	.885	.877	.870
2.	2.924	1.999	1.971	1.942	1.914	1.887	1.860	1.835	1.810	1.785	1.761	1.738	1.715	1.693	1.671
3.	3.120	3.058	2.998	2.940	2.884	2.830	2.778	2.727	2.677	2.629	2.583	2.538	2.494	2.451	2.410
4.	4.264	4.158	4.056	3.959	3.864	3.774	3.686	3.602	3.521	3.443	3.367	3.295	3.224	3.156	3.091
5.	5.466	5.302	5.146	4.996	4.853	4.717	4.586	4.461	4.342	4.227	4.117	4.011	3.909	3.812	3.719
6.	6.726	6.490	6.266	6.054	5.852	5.660	5.478	5.305	5.139	4.982	4.832	4.689	4.552	4.422	4.297
7.	8.049	7.725	7.420	7.132	6.860	6.604	6.361	6.132	5.915	5.710	5.515	5.331	5.155	4.989	4.830
8.	9.438	9.008	8.607	8.230	7.878	7.547	7.237	6.945	6.670	6.411	6.168	5.938	5.721	5.516	5.322
9.	10.895	10.342	9.828	9.358	8.905	8.491	8.104	7.742	7.404	7.087	6.791	6.513	6.251	6.006	5.775
10.	12.425	11.728	11.085	10.492	9.943	9.434	8.962	8.525	8.118	7.739	7.386	7.057	6.749	6.462	6.193
11.	14.030	13.168	12.379	11.655	10.990	10.377	9.813	9.293	8.812	8.366	7.954	7.571	7.216	6.885	6.577
12.	15.714	14.665	13.710	12.841	12.047	11.321	10.656	10.046	9.486	8.971	8.497	8.059	7.654	7.279	6.932
13.	17.482	16.221	15.081	14.049	13.114	12.264	11.491	10.784	10.143	9.554	9.015	8.520	8.065	7.646	7.259
14.	19.338	17.837	16.491	15.261	14.191	13.208	12.310	11.513	10.781	10.116	9.510	8.956	8.450	7.986	7.561
15.	21.285	19.517	17.942	16.536	15.279	14.151	13.138	12.225	11.402	10.657	9.982	9.369	8.812	8.303	7.839
16.	23.329	21.263	19.433	17.816	16.376	15.094	13.949	12.925	12.005	11.179	10.433	9.760	9.151	8.598	8.095
17.	25.474	23.077	20.872	19.120	17.485	16.038	14.754	13.611	12.592	11.681	10.864	10.130	9.469	8.871	8.331
18.	27.726	24.962	22.554	20.449	18.604	16.981	15.550	14.285	13.163	12.166	11.276	10.480	9.767	9.126	8.548
19.	30.088	26.922	24.182	21.804	19.733	17.925	16.340	14.947	13.718	12.632	11.669	10.812	10.047	9.363	8.749
20.	32.568	28.958	25.857	23.185	20.874	18.868	17.122	15.596	14.258	13.082	12.044	11.125	10.310	9.583	8.934
21.	35.170	31.074	27.981	24.592	22.025	19.811	17.896	16.233	14.783	13.515	12.403	11.422	10.556	9.788	9.104
22.	37.901	33.273	29.355	26.027	23.187	20.755	18.663	16.858	15.294	13.933	12.745	11.703	10.787	9.978	9.261
23.	40.768	35.558	31.181	27.482	24.369	21.698	19.424	17.472	15.790	14.335	13.072	11.969	11.004	10.155	9.406
24.	43.776	37.933	33.060	28.979	25.544	22.642	20.177	18.074	16.273	14.723	13.384	12.221	11.207	10.320	9.539
25.	46.933	40.401	34.954	30.498	26.740	23.585	20.923	18.666	16.743	15.097	13.682	12.459	11.398	10.473	9.662
26.	50.247	42.965	36.984	32.046	27.947	24.528	21.662	19.246	17.199	15.457	13.966	12.684	11.577	10.615	9.776
27.	53.724	45.631	39.032	33.623	29.166	25.472	22.394	19.815	17.643	15.804	14.238	12.898	11.744	10.747	9.860
28.	57.374	48.401	41.140	35.232	30.396	26.415	23.119	20.374	18.075	16.138	14.498	13.100	11.982	10.870	9.977
29.	61.205	51.279	43.309	36.871	31.638	27.358	23.838	20.923	18.495	16.461	14.745	13.291	12.050	10.965	10.065
30.	65.225	54.270	45.541	38.541	32.891	28.362	24.549	21.461	18.904	16.771	14.982	13.472	12.188	11.091	10.147
31.	69.444	57.379	47.839	40.244	34.157	29.245	25.255	21.990	19.301	17.070	15.208	13.643	12.318	11.190	10.223
32.	73.871	60.610	50.203	41.979	35.435	30.189	25.953	22.509	19.687	17.359	15.424	13.805	12.440	11.282	10.292
33.	78.519	63.967	52.636	43.748	36.725	31.132	26.645	23.018	20.063	17.637	15.630	13.954	12.554	11.367	10.356
34.	83.396	67.456	55.140	45.551	38.027	32.075	27.331	23.517	20.428	17.904	15.827	14.103	12.662	11.447	10.415
35.	88.514	71.081	57.717	47.389	39.341	33.019	28.010	24.008	20.783	18.162	16.015	14.240	12.762	11.521	10.470
36.	93.886	74.849	60.369	49.262	40.668	33.962	28.683	24.489	21.128	18.411	16.194	14.370	12.857	11.589	10.520
37.	99.524	78.765	63.098	51.170	42.008	34.906	29.349	24.962	21.464	18.651	16.366	14.493	12.945	11.653	10.566
38.	105.441	82.834	65.907	53.116	43.361	35.849	30.009	25.425	21.791	18.882	16.530	14.610	13.028	11.713	10.609
39.	111.651	87.063	68.797	55.099	44.726	36.792	30.664	25.880	22.109	19.104	16.686	14.720	13.106	11.768	10.648
40.	118.169	91.458	71.772	57.120	46.104	37.736	31.312	26.327	22.418	19.318	16.835	14.824	13.179	11.819	10.684

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